SOFTWOOD LUMBER QUALITY REQUIREMENTS: EXAMINING THE SUPPLIER/BUYER PERCEPTION GAP[1]

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ABSTRACT

The major objective of this research was to examine the perception gap that exists between suppliers and buyers concerning softwood lumber quality requirements. In general, suppliers know quite well how their customers perceive the importance of service and product quality, but consistently overrate their performance level relative to how they are rated by their customers. The largest perception gaps exist for the various aspects of lumber aesthetics. Therefore, this may be the area on which mills should concentrate to increase their competitiveness.

Keywords: Softwood lumber, lumber quality, perceived lumber quality.

INTRODUCTION

In general, the term "quality" is used more and more by companies and their advertisers, so often in fact that it is running the risk of losing its meaning (Hansen and Punches 1996). What does quality really mean? Quality has already been defined in many ways, e.g., *fitness for use* (Juran 1974) and *conformance to requirements* (Crosby 1979). Many definitions lack reference to an important aspect of the marketing process—the customer. Definition of product quality internal to the company will not be of much value, because a product will be of high quality only if it meets customer requirements. In practice, the actual quality is a trade-off between what the buyer wants and what the supplier can provide profitably (Hansen and Punches 1996). In simple terms, quality is the ability of a service or product to perform its specified tasks as defined by the customer (Ennew et al. 1993).

Customers feel that quality of softwood lumber has decreased recently (Hansen and Punches 1996). There are three major reasons for this. First, the forest resource is changing. The area covered with old-growth stands is declining, and restrictions have been intensified (Spies and Franklin 1988). Subsequently, second-growth stands have increased in importance as a timber source. But timber derived from second-growth stands is different from that from old growth. Stems are smaller, contain more juvenile wood, and have more large knots. In addition, annual rings are much wider. Timber quality can be improved by special methods of thinning, but this opportunity is limited by the factors of time and money.

Second, grading rules originally installed to ensure a certain level of quality might actually limit quality. Some companies may try to just meet minimum specifications, and not realize the specific quality expectations of their cus-

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tomers. Meeting minimum specifications can be encouraged by technical advances, because such advances again might be focused on better meeting the grading rules (Hansen and Punches 1996). Yet grading rules should not be the sole determinant of product quality. The entire product, including the expectations of customers, product design and engineering, purchase of raw materials and components, design of the manufacturing process, manufacturing operations, and sales and service, determines product quality (Shetty 1987). Thus, some companies, recognizing the limitations of the grading rules, go beyond the rules to satisfy customer quality requirements. The grades often do not refer to their specific needs (Hansen et al. 1996).

Third, the lumber industry typically mass produces. Thus, price and quantity dictate the marketing strategies of the managers and are not geared toward meeting specific quality perceptions of customers (Hansen and Punches 1996).

A main concern of lumber customers is the lack of consistent quality, both mill-to-mill consistency and order-to-order consistency from the same mill (Hansen and Punches 1996). The perceptions of suppliers and customers can differ substantially. Customers may want mills to offer an equal quality standard, yet mills may aim to establish product lines that differ from commodity products. Some lumber users feel that inconsistency in quality, over time, might be the result of changing demand and prices. Escalating demand and prices drive quality down. When demand and prices decline, quality improves. A mill will try to realize higher prices with increased quality and will want to win customers from competitors by distinguishing its product as one of higher quality. A similar correlation may exist between price and service. Mills that maintain a certain level of quality, despite the ups and downs of demand and price, will then be preferred by customers (Hansen and Bush 1996).

Both consistency and differentiation can help suppliers meet specific customer requirements. Because lumber is considered to be a commodity product, it will be easier for suppliers to differentiate themselves on service and operations than on the product (Perkins 1993). Mills can achieve the objective of differentiation by producing specialized or proprietary grades based on standard grading rules. This might be an opportunity for mills to realize higher prices for their products (Hansen and Punches 1996). It is difficult to gain premiums on products placed on the commodity market. Specialized grades are useful only when they meet the needs of an identified consumer segment and when that segment recognizes the value offered by the manufacturer (Hansen and Punches 1996). Being aware of customers' quality perceptions can help suppliers to identify these segments.

Differentiation may give suppliers the opportunity to avoid competition based on price and quantity. A survey carried out by Hansen and Bush (1996) demonstrated that buyers prefer lumber suppliers who provide higher quality. Customers claim to be willing to pay higher prices for improved products and service. Differentiation allows suppliers to avoid struggle in the commodity market, where low price and high quantity dominate marketing efforts. Firms wanting to differentiate should move from traditional commodity production toward niche markets and value adding. Niche marketing allows companies to offer high quality, realize high prices, and avoid price competition.

A change in marketing strategies also might be essential, because of significant changes in the U.S. forest products industry during the past several years. These changes are the result of increasing international competition, competition from substitute products, rising customer expectations, and a shift from a "seller-market" to a "buyer-market." In the past, production and marketing of softwood lumber were based on fitness for use. Nowadays lumber suppliers are more compelled to meet specific demands of their customers because of significant market changes, e.g., significant competition from Canadian mills. This is not

always easy, because the properties of the raw wood material are somewhat given. Hansen et al. (1996) indicate that "suppliers could concentrate on purchasing timber that exhibits quality characteristics that best fit the capabilities of their mill and are most likely to satisfy their customers." Yet available timber supply often limits this ability.

Market changes may require that firms escape from the traditional commodity/production emphasis and shift toward adding value and improving relationships with their customers. Buyers are beginning to dictate the market. Take, for example, the use of barcoding by retailers. Buyers strongly encourage, often even require, suppliers to provide Universal Product Code (UPC)-barcoded products (Vlosky and Wilson 1996).

A growing body of evidence indicates that quality is a significant competitive factor in the softwood lumber industry. Consequently, softwood lumber mills need to understand specific customer quality requirements. In this study, we investigate gaps in the perception of quality between softwood lumber mills and their customers. By recognizing gaps, companies can better position themselves to improve overall product quality and enhance their marketing strategies.

SUPPLIER/SALESPERSON CHARACTERISTICS

1. Friendliness of supplier's salesperson
2. Supplier's salesperson giving individualized attention
3. Ease of understanding supplier's salesperson
4. Supplier understanding your needs
5. Being treated with respect by supplier's salespeople

LUMBER PERFORMANCE

6. Stiffness/strength of lumber
7. Durability of lumber
8. Fastener retention
9. Failure rate of lumber in service
10. Long service life of lumber

LUMBER CHARACTERISTICS

11. Neat, undamaged lumber pack
12. Overall lumber appearance
13. Clean lumber/pack
14. Accuracy and consistency of machining
15. Lumber straightness
16. Accuracy and consistency of grading

SUPPLIER SERVICES

17. Supplier offering a variety of species
18. Protective wrapping of lumber packs
19. Supplier's willingness to supply mixed loads
20. Supplier's willingness to fill small orders
21. Credit terms offered by supplier
22. Supplier-arranged shipping
23. Firm prices quoted by supplier

FIG. 1. Condensed measurement model for softwood lumber quality (Hansen and Bush 1996).

MATERIALS AND METHODS

Data collection

Data for quantifying the quality perception gap between suppliers and customers were gathered through personal interviews with personnel in lumber mills and personnel in a main customer firm of each of the mills. Because we needed to gain the participation of both supplier and customer firms, we utilized a purposive sample scheme consisting of 26 companies and 62 respondents. Companies were chosen carefully to best serve the research purpose (Chumhill 1991). In total, 35 mill employees from 13 different mills, accounting for approximately 1.1 billion board feet (22%) of production in Oregon in 1995, were interviewed (WWPA 1996). Twenty-seven employees from the respective customer firms were also interviewed.

Firms in western Oregon were targeted, based on results of a previous survey completed at the Department of Forest Products, Oregon State University. The primary component of the interviews was the rating of product and service quality on the basis of a condensed model of quality consisting of the four dimensions, SUPPLIER/SALESPERSON CHARACTERISTICS, LUMBER PERFORMANCE, LUMBER CHARACTERISTICS, and SUPPLIER SERVICES, and 23 associated items (Fig. 1).

Mill respondents were asked to rate the importance of the items, as well as the perfor-

TABLE 1. *Distribution of positions covered by respondents.*

Mills				Customer firms			
Mill #	Mill manager	Quality-ontrol supervisor	Salesperson	Firm #	Manager	Quality-control supervisor	Purchasing agent/ officer
1	x	x	x	1	x		
2	x	x	x	2			x
3	x	xx		3	x		x
4	x			4	x		x
5	x	x	x	5	x	x	x
6	x	x	x	6			xx
7	x	x	x	7			xxx
8	x	x	x	8		xx	x
9	x		x	9			x
10	x	x	x	10			x
11	x	x		11	x	xx	
12	x	x	x	12	x		xx
13	x	x	x	13	x		x

mance of their company from the perspective of their main customer. Thus, they rated how they thought their main customer would rate their company's performance in providing the 23 items and the four dimensions, and they rated their perceptions of how important each item and each dimension is for their customers. Customer respondents were asked to rate the importance of the items and the performance of the specific mill. The items were worded identically for mill and customer respondents.

Targeted mill respondents consisted of a mill manager, a quality-control supervisor, and a salesperson in each of the 13 lumber mills. However, the three targeted respondents were successfully interviewed in only 9 mills. In 2 small mills, the mill manager also covered the salesperson's position. In one of those 2 mills, a second quality-control supervisor participated. In another small mill, only the mill manager could be interviewed. At another mill, a quality-control supervisor wasn't available (Table 1).

Targeted customer respondents consisted of an upper-level manager, a quality-control supervisor, and a purchasing agent. However, the structure of customer firms allowed for all three in only one case. In several companies, especially wholesalers, only one or more purchasing agents/officers dealing with the specific mill could be interviewed (Table 1). The purchasing agents/officers often covered a salesperson's function, too. For most of the mills, main customers participating in the project were located in Oregon. Questionnaires were sent to two customer firms in Washington and one in California.

Quadrad analysis

A survey carried out by Deshpande et al. (1993) in Japan indicated that the supplier's own assessment of customer orientation did not fit with the customer's evaluation of the supplier's customer orientation. Customer perceptions of the degree to which a firm is customer-oriented are more critical for successful business performance than the seller's perceptions. The gap between the seller's and customers' perceptions of how customer-oriented the seller is could indicate that the seller is out of touch with the market. This situation can be dangerous, especially when a firm believes that it is customer-oriented. For the purpose of revealing that gap, Deshpande et al. used Quadrad Analysis. A Quadrad (double dyad) is a double pair of interviews, each conducted with a pair of marketing executives at a vendor firm and a pair of purchasing executives at a customer firm. These dyad pairs are carefully matched pairs of manufacturers and their key customers.

Data requirements for research on these issues are very demanding. First, self-reporting on such matters as customer-orientation is insufficient, so data from customers are required. Second, customers cannot be expected to profile a supplier's attributes clearly. Subsequently, data from suppliers are also needed. These needs result in a complex and expensive research design (Deshpande et al. 1993).

In this study, research was based on Quadrad Analysis, as introduced by Deshpande et al. (1993), with matched supplier-buyer pairs. The aim was to use matched mill-customer triplets. Both Quadrad Analysis and matched mill-customer triplets not only provide a "one-way evaluation" of quality by the customers, they also assess the accuracy of the mills' knowledge of their customers' perceptions. The gaps within the triads can be revealed, too. This was possible for the mills' triad, but not for the customers', because most of the respondents on the customer side held the same position, namely that of the purchasing agent/officer.

Method of administration

The use of personal interviews allowed numerous options that would not have been possible with other methods. The interview process enabled the reseacher to select appropriate persons within specific firms. The interviewer was able to explain questions, probe for in-depth answers, and be sure that the respondent provided complete answers (Churchill 1991). Personal interviews also gave the researcher the opportunity to interact with the respondent, and offered a better understanding of the dynamics of the relationship between suppliers and buyers. Additional information not covered by the questionnaire was gained, and topics of specific interest to respondents were included in the analysis. These considerations were particularly important for this research, because data analysis was limited as a result of the small sample size. Subsequently, we had to distinguish strictly between statistical and nonstatistical analyses. The questionnaire was printed on paper and handed out to the respondents. Clarification was given to respondents on specific questions or items, but wasn't often requested.

TABLE 2. *Alpha values of measurement scales.*

Scale Dimension	Alpha
Performance	
Supplier/Salesperson Characteristics	0.8555
Lumber Performance	0.8560
Lumber Characteristics	0.9124
Supplier Services	0.6877
Importance	
Supplier/Salesperson Characteristics	0.6708
Lumber Performance	0.7887
Lumber Characteristics	0.8829
Supplier Services	0.7551

ANALYSIS AND DISCUSSION

Reliability of the measurement scale

Although the sample size was small, the measurement scales used are highly reliable. Coefficient alpha as a measure of internal consistency, ranging from 0.7 to 0.9, was high for the performance scales of all four dimensions. Alpha was also large, again ranging from 0.7 to 0.9, for the importance scales of all four dimensions (Table 2). The importance and the performance scales were considered to be independent measuring instruments. This was confirmed by low-paired sample correlations and significant differences of paired sample *t*-tests for most of the items.

Univariate analysis

Independent-samples *t*-tests and Mann-Whitney *U*-tests were employed to reveal whether or not significant differences existed between the particular respondent groups. Differences between all mill respondents and all customer respondents were investigated. Further, differences among the "subgroups" were investigated. The subgroups are: mill manager, mill quality-control supervisor, and salesperson on the mill side, and manager, quality-control supervisor, and purchasing agent/officer on the customer side.

In general, very few significant differences were found among the performance ratings of subgroups, regardless of the statistical test applied. Few meaningful differences were found among the subgroups of either the mill respondents or the customer respondents, likely because of the small sample sizes. This especially holds true for those few differences found between the subgroups manager (customer firm) and quality-control supervisor (customer firm), because these groups were very small (frequency: 7 and 5 respondents, respectively). In comparing the means of the particular mill subgroups to the particular customer subgroups, only one pair is worthy of note. That pair is mill salespersons versus customer purchasing agents/officers. The Mann-Whitney *U*-statistic revealed significant differences regarding this pair for the same items as revealed by the *t*-test for all mill respondents compared to all customer respondents. This means that the largest differences in performance ratings exist between salespeople and purchasing agents/officers, i.e., those persons who are supposed to cultivate and maintain the contact between mills and customer firms. These differences might be a function of the number of respondents in these two subgroups. These two groups were larger than the other groups, and the larger the group size, the more likely one is to detect differences. No meaningful differences were found among the average importance ratings of all six subgroups.

Mean performance ratings of 35 mill respondents and 27 customer respondents regarding each single item and each single dimension were compared with the *t*-test. Significant differences, $\alpha \leq 0.05$, were found for about a quarter of the 23 items and for the dimensions LUMBER PERFORMANCE, LUMBER CHARACTERISTICS, and SUPPLIER SERVICES (Table 3). In addition, significant differences, $\alpha \leq 0.10$, were found for about half of the 23 items. Requirements for applying the independent-samples *t*-test were met for the most part. The *F* tests suggest that variances don't differ significantly, and z values confirm the normality of rating distributions for nearly all of the items. Because the ratings of a few items were not normally distributed, to gain additional support, the Mann-Whitney *U*-test was performed. The Mann-Whitney *U*-test is the most popular of the two independent-samples tests and is used if data are not normally distributed. In fact, it can be used to compare items measured with an ordinal scale.

The Mann-Whitney *U*-test revealed significant differences for nearly the same items as the independent-samples *t*-test (Table 3). The particular dimension ratings corresponded roughly to the single item ratings of each dimension. Results of the test indicated that significant differences exist for the dimensions LUMBER PERFORMANCE, LUMBER CHARACTERISTICS, and SUPPLIER SERVICES. Significant differences were found for at least two items of each of these three dimensions (Table 3).

Only a very few significant differences were found between the importance ratings of mill respondents and customer respondents according to the Mann-Whitney *U*-test. These differences may have occurred by chance as a result of multiple tests, and were not subjected to further interpretation. The Mann-Whitney *U*-test was used, because most of the importance ratings were not normally distributed. The independent-samples *t*-test was not applied, because one requirement for the *t*-test is that ratings be normally distributed.

Variation of ratings

A measure of rating variation is the coefficient of variation, which is expressed by the standard deviation divided by the mean multiplied by 100. The coefficient of variation ranged mostly from 10 to 25% for both importance and performance ratings. In general, rating variation was low.

Even though performance rating variation was low, it was greater for customer respondents than for mill respondents. The reason for this difference probably lies in the variety of

TABLE 3. *Significant differences according to statistical tests used to compare performance between supplier and customers.*

Dimension Item	*t*-test	Mann-Whitney *U*-test
Supplier/Salesperson Characteristics		
Friendliness of supplier's salesperson		
Supplier's salesperson giving individualized attention		
Ease of understanding supplier's salesperson		x[a]
Supplier understanding your needs		
Being treated with respect by supplier's salespeople	x[a]	
Lumber Performance	x[b]	x[b]
Stiffness/strength of lumber		x[a]
Durability of lumber	x[b]	x[b]
Fastener retention		
Failure rate of lumber in service		
Long service life of lumber	x[a]	x[a]
Lumber Characteristics	x[b]	x[a]
Neat, undamaged lumber pack	x[b]	x[a]
Overall lumber appearance		
Clean lumber/pack		
Accuracy and consistency of machining	x[b]	x[b]
Lumber straightness	x[a]	x[b]
Accuracy and consistency of grading		
Supplier Services	x[b]	x[b]
Supplier offering a variety of species		
Protective wrapping of lumber packs	x[a]	x[b]
Supplier's willingness to supply mixed loads	x[b]	x[b]
Supplier's willingness to fill small orders		
Credit terms offered by supplier		
Supplier-arranged shipping	x[b]	x[b]
Firm prices quoted by supplier	x[b]	x[b]

[a] Means of mill and customer respondents differ significantly, $\alpha \leq 0.10$.
[b] Means of mill and customer respondents differ significantly, $\alpha \leq 0.05$.

customer firms participating in this project. This effect was especially manifested within the LUMBER CHARACTERISTICS dimension. Coefficients for customer respondents were consistently larger than for mill respondents. Some customer respondents stated that the visual appearance of the product, which is mainly represented by the items of the dimension LUMBER CHARACTERISTICS, is very important for companies or even the individuals to whom they sell their lumber. Representatives of those companies or individuals evaluate lumber primarily on the basis of visual characteristics, such as "neat, undamaged lumber pack," "overall lumber appearance," and "clean lumber/pack."

Variations of importance ratings were similarly low, but not consistently greater for either mill respondents or customer respondents. For many items of the SUPPLIER SERVICES dimension, coefficients based on importance ratings were considerably larger for customer respondents. This is to be expected, because specific services are demanded only by specific customers. There were small differences in importance ratings of mill and customer respondents within three dimensions, SUPPLIER/SALESPERSON CHARACTERISTICS, LUMBER PERFORMANCE, AND LUMBER CHARACTERISTICS. In addition, both groups displayed similarly low coefficients of variation for these three dimensions (range from about 15 to 25%).

Comparison of importance ratings

Mill respondents did a very good job of estimating how important each item is for their

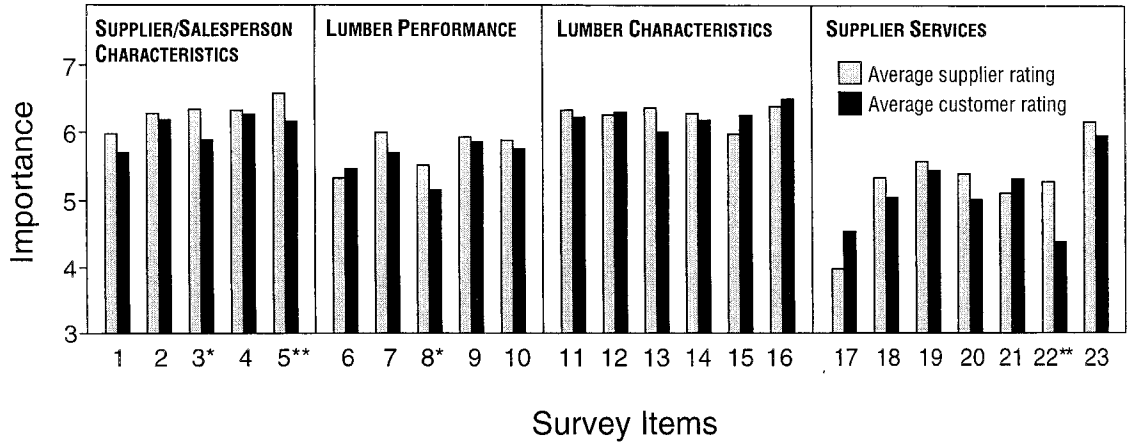


FIG. 2. Average importance ratings of survey items (defined in Fig. 1) by mills and their customers. Means of mill and customer responses differ significantly, * indicates $\alpha \leq 0.10$ and ** indicates $\alpha \leq 0.05$, Mann-Whitney U-test.

customers (Fig. 2). Importance ratings of mill respondents did not differ significantly from those of customer respondents on nearly all items. Regardless of the dimension, mill respondents slightly overestimated the importance of more than half of the items. The item most overestimated in importance was "supplier-arranged shipping." "Supplier-arranged shipping" doesn't seem to be a big issue for customers. Some customer respondents stated that it is just "an issue of negotiation" for them.

Both mills and customers rated items of the two dimensions, SUPPLIER/SALESPERSON CHARACTERISTICS and LUMBER CHARACTERISTICS, highest in importance. Items of dimension LUMBER PERFORMANCE were rated slightly lower, and those of dimension SUPPLIER SERVICES were rated lowest of all. However, all dimensions received fairly high ratings. The range of ratings was largest in the last dimension, SUPPLIER SERVICES. "Supplier offering a variety of species" was the least important of all items, and "firm prices quoted by supplier" was the most important item of SUPPLIER SERVICES.

Only a few items were ranked much more important by mill respondents than by customer respondents (Table 4). These items were "being treated with respect by supplier's salespeople" and "ease of understanding supplier's salesperson." Customers don't seem to be as concerned about these things as mill respondents expect them to be. Instead, customer respondents rated a couple of items much more important than did mill respondents. These items were "overall lumber appearance" and "lumber straightness." Both items belong to the LUMBER CHARACTERISTICS dimension and are basic visual attributes of lumber. "Accuracy and consistency of grading" was ranked most important and second most important by customer respondents and mill respondents, respectively.

Comparison of performance ratings

Mill respondents consistently overrated their performance in comparison to that perceived by customer respondents. Approximately half of the items were rated significantly higher by mill respondents than by customer respondents (Fig. 3). Differences between mills and customers were lowest concerning SUPPLIER/SALESPERSON CHARACTERISTICS, which were rated highest in performance by both. Mill salespeople are apparently doing a good job. The largest differences within LUMBER PERFORMANCE were found only for the items "durability of lum-

TABLE 4. *Mean importance ratings and importance rankings of survey items by mill respondents and customer respondents.*

Item	Mill respondents		Customer repsondents	
	Mean rating	Rank	Mean rating	Rank
Being treated with respect by supplier's salespeople	6.57	1	6.15	7
Accuracy and consistency of grading	6.37	2	6.48	1
Ease of understanding supplier's salespeople	6.34	3	5.89	11
Clean lumber/pack	6.34	4	6.00	9
Neat, undamaged lumber pack	6.34	5	6.22	4
Supplier understanding your needs	6.29	6	6.26	3
Accuracy and consistency of machining	6.26	7	6.15	8
Supplier's salesperson giving individualized attention	6.26	8	6.19	6
Overall lumber appearance	6.26	9	6.30	2
Firm prices quoted by supplier	6.15	10	5.93	10
Friendliness of supplier's salesperson	6.03	11	5.74	13
Durability of lumber	6.00	12	5.69	15
Lumber straightness	5.94	13	6.22	5
Failure rate of lumber in service	5.91	14	5.88	12
Long service life of lumber	5.86	15	5.73	14
Supplier's willingness to supply mixed loads	5.56	16	5.41	17
Fastener retention	5.52	17	5.13	19
Supplier's willingness to fill small orders	5.37	18	4.96	21
Protective wrapping of lumber packs	5.32	19	5.04	20
Stiffness/strength of lumber	5.31	20	5.46	16
Supplier-arranged shipping	5.26	21	4.35	23
Credit terms offered by supplier	5.09	22	5.30	18
Supplier offering a variety of species	3.94	23	4.48	22

ber" and "long service life of lumber." Differences in performance perceptions between mills and customers concerning LUMBER CHARACTERISTICS were greatest in "accuracy and consistency of machining" and "lumber straightness," and smallest in "accuracy and consistency of grading." Although mills are doing a good job of meeting grading

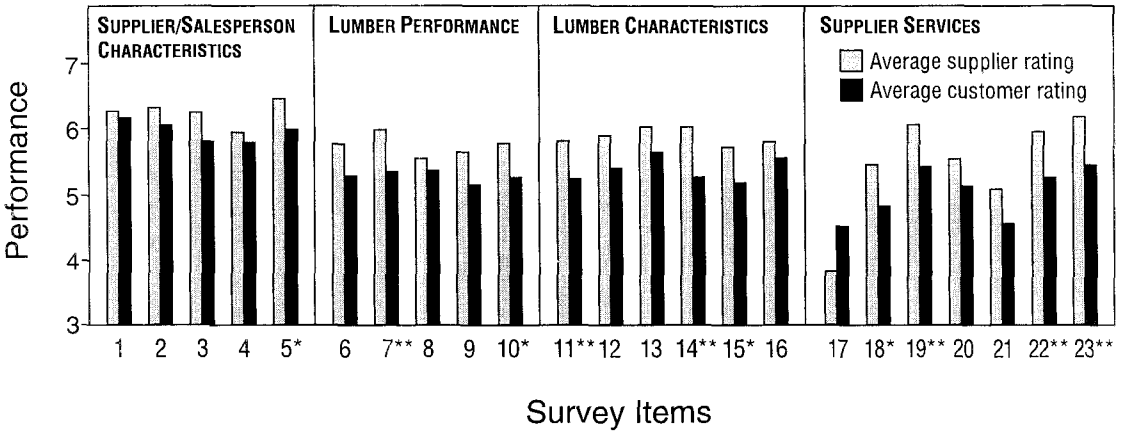
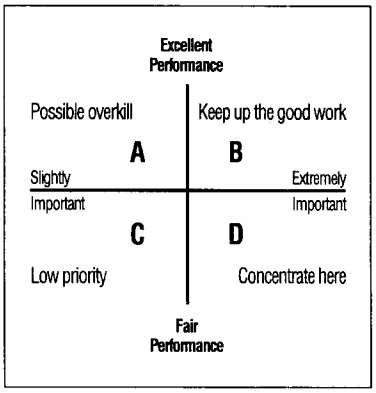


FIG. 3. Average performance ratings of survey items (defined in Fig. 1) by mills and their customers. Means of mill and customer responses differ significantly, * indicates $\alpha \leq 0.10$ and ** indicates $\alpha \leq 0.05$, independent-samples *t*-test.



A Possible overkill: The supplier is judged to be doing a good job, but customers attach only slight importance.

B Keep up the good work: Firms performing well on dimensions rated important by their customers are doing a good job.

C Low priority: The supplier is rated low in performance concerning a specific dimension, and customers do not perceive this dimension as very important.

D Concentrate here: Firms ranking low in performance on a dimension rated as highly important should consider making the changes necessary to satisfy their customers.

FIG. 4. Importance-performance grid (Martilla and James 1977).

rule requirements, comments from customers suggest that they are not satisfied with the overall grading system and its impact on product quality, even though they still accept and acknowledge good grading. Also, good SUPPLIER SERVICES are demanded by customers, but mills must carefully consider the type of service they need to provide for a specific customer.

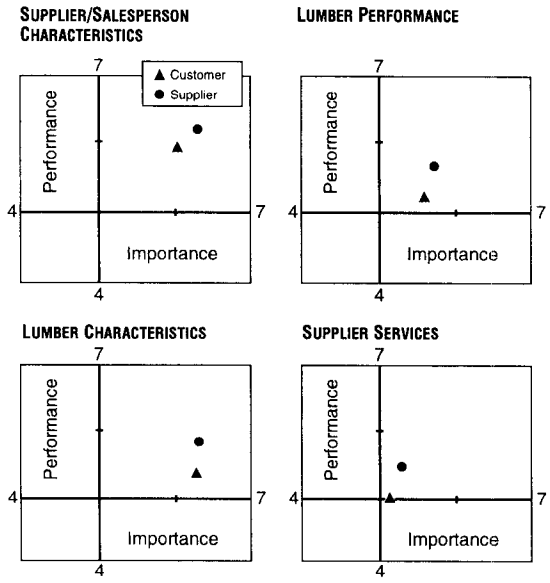


FIG. 5. Importance-performance grids of the four dimensions surveyed for customer and supplier respondents.

Importance-performance analysis of ratings

Importance-performance analysis allows results to be graphically displayed on a two-dimensional grid, thus enabling easy interpretation (Martilla and James 1977). The importance-performance grid (Fig. 4) consists of two axes. The vertical axis represents how well a company performs and the horizontal axis represents the relative importance of the item or dimension. Both the customer's and the supplier's evaluation can be plotted on the grid.

All the average dimension ratings for importance and performance are located in quadrant "B," which advises mills to "keep up the good work." Nevertheless, there are distinct differences among dimensions in that quadrant. As mentioned before, importance ratings of mill respondents were very close to those of customer respondents, with slightly larger differences for performance ratings. Mill respondents overestimate slightly, but consistently, their performance; however, they know quite well how important specific features are for their customers.

SUPPLIER/SALESPERSON CHARACTERISTICS was rated very important and high in performance by both groups of respondents (Fig. 5). Consequently, this may not be the best place to invest for improvements. A high level of performance has already been realized.

LUMBER PERFORMANCE was rated slightly higher in importance than performance (Fig. 5). Both mill respondents and customer respondents stated that the items of this dimension were most difficult to evaluate and to rate. Customer comments specifically indicated that it was difficult to assign these ratings to certain mills.

Although mill respondents estimated their customers' perceptions of the quality provided by the mill rather well, and seem to know what is important to their customers, it is quite clear that the LUMBER CHARACTERISTICS dimension is the one for mills to work on. LUMBER CHARACTERISTICS was rated most important, but performance was rated very low in comparison. As can be seen in Fig. 5, importance ratings were similar for both sets of respondents. Mills are aware of the importance of lumber characteristics, but are not performing at the level they think they are. Therefore, the dimension LUMBER CHARACTERISTICS could hold considerable potential for improvement. This dimension mainly represents visual attributes, including lumber pack, and the very technical attributes, machining and grading. This may be where companies should focus improvement efforts. The SUPPLIER SERVICES dimension was rated least important and lowest in performance (Fig. 5).

The six different positions covered by respondents were: (1) mill manager, (2) mill quality-control supervisor, (3) salesperson, (4) manager of a customer firm, (5) quality-control supervisor of a customer firm, and (6) purchasing agent/officer. A closer look at the ratings of the particular positions suggests two things (Fig. 6): First, regardless of the dimension, mill salespeople rated performance highest among mill respondents. Second, customer managers rated performance highest among customer respondents, regardless of the dimension. Please note, the sample of 62 respondents includes only five customer quality-control supervisors and seven customer firm managers.

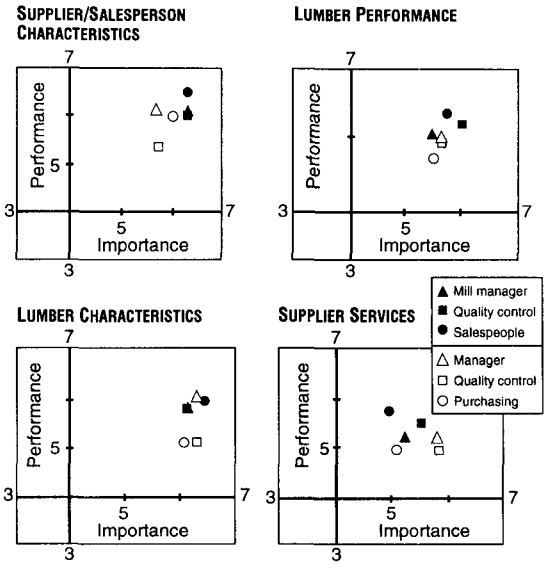


FIG. 6. Importance-performance grids of the four dimensions surveyed for all six positions covered by respondents.

CONCLUSIONS

Mills should strive to maintain the good relationships they have apparently developed with their main customers. Customers acknowledge the importance of a good reliable personal relationship with the mill staff. Future quality improvement efforts by suppliers should be concentrated on such lumber characteristics as appearance, clean lumber/pack, and consistency of machining and grading. Mills meet grading rule requirements quite well. This is acknowledged by customers, but comments from customers suggest that they are not satisfied with the overall grading system and its impact on product quality. Customer respondents stated that visual attributes such as "neat undamaged lumber pack," "overall lumber appearance," and "clean lumber/pack" are gaining higher importance. This may be where companies will compete in the future. Further, it is important for mills to determine which services their customers truly demand. Some services are demanded only by specific customers.

APPLICATION

Systematic measurement of quality by individual mills can be accomplished by methods similar to those used in this research project. Items used to measure dimensions should be tailored to individual mills. This can be done by beginning with the respecified 5-dimension model of total product quality (70 items, 5 dimensions) (Hansen and Bush 1996). Customer respondents would then rate items on importance. Subsequently, a condensed model, similar to the 23-item and 4-dimension model of this research, would be designed for the specific mill. The model would consist of the most important items and those most highly correlated with the dimensions. A questionnaire would then be sent to customer firms on a regular basis (e.g., once a year). Customer respondents would be asked to rate the particular mill's performance and the importance of each of the items. This procedure allows the mill to monitor total lumber quality as perceived by customer firms. It would be very helpful to monitor the perceptions of mill personnel, too. In addition, customer respondents may be asked to rate total lumber quality provided by the most important competitors of the mill. Importance-performance analysis provides a useful and very simple method for analyzing and interpreting the data. The plots thus generated enable a mill to map out its performance relative to that of its competitors.

Although the sample size is often small, it likely represents a large volume of production; therefore, statistical comparisons may not be necessary. Statistically significant data will be rare, but are not essential for mills. Even single ratings of a mill's respondents' perceptions of its total lumber quality, customer respondents' perceptions of the mill's total lumber quality, and customer respondents' perceptions of total lumber quality provided by the mill's competitors are valuable. Further, single ratings can be effectively utilized with importance-performance grids.

Utilizing a model particularly designed for a specific mill to monitor the importance of quality to the customer firm, performance in providing it, and the performance of competitors may not only facilitate strategy development, it may also increase supplier/customer interaction, thus fostering stronger relationships.

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